field can be developed in fish, but not in pigeons or rabbits (despite the alleged effects of magnetic fields on the former). Human visual images are altered during exposure to a magnetic field under the influence of hypnosis (see the discussion at the end of this report) and mescaline. Kholodov restated his belief that magnetic fields primarily affect glial cells, as reflected in individual neuron activity (perhaps he was referring to his 1965 research, although he did not cite any publications in this paper). He also stated that "magnetically treated water has a biological effect," although he did not discuss the mechanisms or pathways of this alleged phenomenon.

In general, it would appear from Kholodov's statements and research that the effects of low-frequency EMF's and magnetic fields (especially intermittent ones) have a direct effect on neural structures, and that these effects are similar to those produced by nonthermal microwave intensities. It will be extremely interesting to see whether Kholodov's view that the diencephalon and glial cells are specific EMF and MF receptors will be borne out by future Soviet research.

6. Clinical, therapeutic, and hygienic aspects

Soviet concern for the actual effect of microwave-range EMF's on humans has been no less intense than their theoretical interest in these fields. Moreover, this report will show that the last two years (especially 1966) have yielded a dramatic increase in the volume of material devoted to the therapeutic, clinical, and especially hygienic aspects of human exposure to microwaves and even magnetic and electric fields. Presently, the chief spokesman for hygiene is Yu. A. Osipov [32].

Otherwise, smaller and more isolated groups are sporadically active in this field. Atanelishvili [30], for example, compared the effects of various physiotherapeutic procedures on human motor response to light. The effects of UHF, diathermy, and pine baths were investigated. No UHF radiation parameters were described. A total of 71 patients with gastric disorders was examined, 41 of whom received UHF therapy. Atanelishvili found that UHF stimulated motor reactions in the majority of cases. However, he obtained basically the same results from diathermy and bath procedures, rendering any conclusions as to the specific effects of UHF on the central nervous system doubtful. He concluded that all three procedures altered the functional state of the CNS, which undoubtedly plays a prominant role in the positive effects of therapy.

As regards the hygienic aspects of human exposure to microwaves, it should be noted that this area of concern is of interest to both the military and civilian communities. The Soviet military medical service has played an active role in assessing hygienic conditions and the state of workers exposed to radar fields. Kapitanenko [31] conducted a clinical investigation on 100 young military personnel (66 exposed to radar, 34 control). UHF fields were generated by decimeter and centimeter generators. He did not provide any dosimetry data.

Kapitanenko concluded that the nervous system was the first system to react to UHF, and that the severity of neurological disorders was a function of field intensity and duration of exposure. Asthenia was a prominant neurological symptom of the deleterious effect of UHF. Cardiovascular disorders, also observed, were not sharply pronounced and were judged to be reversible. No specific therapy for UHF symptoms is known, although positive results have been obtained from: 1) intravenous injection of a 40% glucose, 5% ascorbic acid solution (dose and frequency of administration not given); 2) a strychnine and securinine solution (dose and administration details not given); 3) ginseng (no details given); and 4) 0.005 g of dibasol three times per day.

In his book reviewing hygienic problems of human exposure to microwave-range EMF's, Osipov (1965) [32] considered data from as far back as 1933 relative to the effects of microwave-range EMF's on the human nervous system and other systems. Among the many human CNS symptoms of microwaves consistently reported by Soviet observers are: loss of memory, migraine headaches, insomnia, dizziness, irritability, dermographism, and loss of appetite. Autonomic disorders have been characterized by changes in cardiac, hepatic, and gastrointestinal function. As Osipov sees it, autonomic dystonia is a common symptom of exposure to microwaves. He concluded that the most common and persistent neural symptoms of microwaves are neurasthenia and autonomic (primarily vagotonic) dystonia. These symptoms are also observed as a result of exposure to the combined effects of microwaves and x-rays. Most microwave-induced shifts are reversible, e.g., pathological damage to neural structures is usually insignificant, according to Osipov. Rarely, microwaves can cause hallucinations, syncope, and adynamia (the diencephalic syndrome).

Osipov feels that the effects of EMF's are qualitatively identical within a wide spectrum (from long to ultrashort waves, 100 kc to 30,000 kc). His opinion is well borne out by the articles reviewed in this report, and although he does not discuss problems of exposure to purely magnetic and electric fields, it should be noted that Vyalov et al.[38] mention many symptoms characteristic of microwave effects (headaches, tremors, elevated pain sensitivity, dermographism) in workers exposed to constant magnetic fields (150—1500 oe). Asanova [39] reported characteristic microwave symptoms (dermographism, cardiovascular shifts, tremors, hyperhydrosis, headache, fatigue, asthenia, drowsiness) in workers exposed to electric fields (115—125 μ amp) in 400—500-kv hydroelectric stations.

Osipov also notes reports of reduced sexual potency and baldness induced by microwave-range EMF's. He feels that the latter might be attributed to the neurasthenic syndrome, although he states that a "psychological factor" should not be discounted.

It should be mentioned that Osipov, unlike Presman, Kholodov, Kamenskiy, and others, is inclined to regard the low-intensity effects of microwaves as "microthermal" effects rather than nonthermal effects.

Since Osipov's comprehensive review, there has been a virtual deluge of articles from the Institute of Industrial Hygiene and Occupational Diseases devoted to the hygienic aspects of meter-to-centimeter-range fields. Here the military effort should not be belittled. Smurova et al. [33] investigated medical personnel working around physiotherapy generators (1.6 to 2450 mc, λ equals 184 m to 12.2 cm). He found that working conditions around these sources

exceeded permissible exposure limits, e.g., 20 v/m or 10 mw/cm^2, by as much as two orders of magnitude (170—1000 mw/cm^2). Here again, the characteristic EMF syndromes were noted (headache, irritability, insomnia, chest pain, dermographism, acrocyanosis, hand tremor, etc.). Impairment of light sensitivity and dark adaptation were judged to reflect increased CNS sensitivity. The characteristic cardiac symptoms were also noted. Smurova concluded that the wide wave range of fields studied were deleterious to human health, an observation which agrees with the findings of Osipov [32].

Drogichina et al. (1966) [34] concentrated on the autonomic and cardiovascular disorders of personnel exposed to microwave-range fields up to a "few mw/cm^2" in intensity. Along with the familiar asthenic syndrome, this group found that autonomic cardiac disorders were the most persistent characteristic of exposure to microwaves. They also attributed diencephalic disturbances (interesting in view of the theoretical material discussed in this report) and coronary spasms to microwaves.

Fukalova [35] sought to establish permissible limits for personnel exposed to shortwave (6—450 v/m) and ultrashort-wave (4—220 v/m) sources. She concluded that all observed CNS symptoms caused by these EMF's were aggravated by inefficient work-rest cycles. Fatigability was the most prominent of the familiar CNS symptoms observed.

To establish exposure norms, Fukalova exposed animals to 14-, 88-, and 69.7-mc fields (5000 v/m) and found that animals in the ultrashort-wave range were killed within 5 min, while 1 hr and 40 min was required for death in the shortwave field. She found the nonthermal threshold intensity (no increase in body temperature) for ultrashort waves was 150 v/m and for short waves, 2250 v/m. Chronic (duration not specified) exposure to these intensities caused a decrease in medulla oblongata cholinesterase activity more rapidly during exposure to ultrashort waves than during exposure to short waves. Brain biopotentials were depressed. An ultrashort-wave intensity of 10 v/m and a shortwave intensity of 50 v/m were found to be "threshold irritants." As in Lobanova's study [7], an ultrashort-wave intensity of 150 v/m was sufficient to cause thickening of neural fibers, protoplasmic swelling and vacuolization in the thalamo-hypothalamic area and medulla oblongata, and local karyocytolysis of individual neurons. Shriveling of occasional cortical pyramid cells and neuron vacuoles was also noted. On the basis of these data, permissible human exposure intensities (duration of exposure not given) were set at 5 v/m for ultrashort-wave fields and 20 v/m for shortwave fields.

The Soviet military medical service regards the neural and other effects of microwave-range EMF's no less seriously than the civilian community. Professor I. R. Petrov [36], a Major General in the medical service and member of the Academy of Medical Sciences USSR, concurs with the findings of the civilian community in that a microwave-field intensity greater than 10 mw/cm^2 constitutes a thermal hazard, and that microwave-range EMF's directly affect the human CNS.

Panov [37] in a recent article not only agrees that microwave-range EMF's directly affect human neural processes, but classifies these effects into three familiar symptoms: 1) the neurasthenic syndrome (reversible), ambulatory treatment indicated; 2) autonomic vagotonic dystonia (occasionally stable and irreversible), bed rest indicated; and 3) the diencephalic syndrome (visceral dysfunction, hypersomnia, hypokinesia, latent or overt hypothalamo-hypophoseal-adrenal depression, depressed sexual and food reflexes). Diencephalic changes are not always reversible and bed rest is indicated.

Thus, this section reflects the unanimity of the Soviet civilian and military communities, which feel that microwave-range EMF's (above 10 mw/cm^2) constitute an occupational hazard and that these fields affect the human central nervous system. Some of the clinical observations discussed in this section would tend to support the findings of such researchers as Presman, Kholodov, Kamenskiy, and others, who feel that microwaves exert a specific or nonthermal effect on neural structures.

Discussion

From the foregoing material, little doubt can remain that the majority of the extensive Soviet community concerned with the biological effects of EMF's (and MF's) are of the opinion that these fields, especially in the microwave range, directly affect neural structures and that neural structures (especially the CNS) are the most sensitive to microwave-range EMF's. CNS effects have been observed as a result of exposure to both nonthermal and thermal intensities of pulsed and nonpulsed microwaves. The research of the military and civilian communities has been largely parallel. There is some recent evidence that purely magnetic and electric fields can be included as microwave-like CNS stimuli.

At the present time, Soviet opinion holds that EMF's: 1) affect the structure and chemical reactivity of neural cells (Pressman [5,6,8], Kholodov [10,26,27], Kamenskiy [11], Tolgskaya [4], Livshits [1,2], and Lobanova [7] and others; 2) that they may also affect the molecular structure of neural structures by virtue of resonant or other absorption (Presman [5,6]; and 3) that the effects of EMF's are qualitatively analagous for a wide frequency range

(100—30,000 kc) and that nonthermal effects may, in fact, be of a "microthermal" nature in the absence of more concrete evidence to the contrary (Osipov [32] and Presman [6]).

The relationship between Osipov [32] and Presman [6] should be mentioned since there is a slight disagreement between the two relative to the nonthermal effects of microwaves. Osipov, while admitting there is evidence that microwaves have a biological, and especially a neural effect at field intensities which do not produce perceptible thermodynamic changes, feels that it is experimentally impossible to demonstrate a specific, e.g., nonthermal, microwave effect by comparing that alleged effect with a thermoequivalent control. He reasons that since biological objects are electrically heterogeneous and since microwave-range EMF's have a known selective thermal effect on various tissues and organs, a difference between a microwave effect and a neutral heat effect is not necessarily due to an unknown extrathermal factor, but might well be a function of an uneven distribution of heat in the organism which could exert its own peculiar effect. The specific action of a microwave EMF, in Osipov's view, should only be understood as a demonstrable transfer of EMF energy into nonthermal energy. He therefore feels that the many alleged "nonthermal" microwave effects accepted by Presman may well be "microthermal" effects in the absence of conclusive experimental evidence to the contrary.

Presman, on the other hand, is more inclined to believe that if a microwave EMF does not result in any perceptible temperature shifts in an organism, then any change in its behavior, function, or structure can be attributed to the nonthermal mechanism of the EMF, even if it is experimentally impossible to demonstrate that thermogenic and nonthermogenic EMF intensities each give rise to different reactions. In short, Presman feels that there is ample evidence of the nonthermal effects of microwave-range EMFs by virtue of an absolute temperature criterion while Osipov feels that, while nonthermal effects are entirely possible, they have not as yet been as well substantiated physiologically as thermal effects.

Far from abating, Soviet research efforts in this area show every indication of continuing at their present pace or even intensifying, as reflected in the recent large review articles, chiefly by Presman and Osipov. Presman's last comprehensive review, like Osipov's, was published in the last half of 1965. At the time of that writing, he estimated that approximately 1000 works had been published on the biological and medical aspects of microwave-range EMF's. That review, unlike his previous ones, concentrated heavily on the possible mechanisms of EMF biological effects. Most of the recent articles discussed in the 1965 review were cited by him as evidence of thermal, and, most interesting, nonthermal or specific effects of EMF's. Therefore, it would not be imprudent to expect that more attention will be paid to the biophysical mechanisms of nonthermal EMF neural effects than has been in the past, although at the present time, there is little evidence to support this expectation.

What the purpose is of such intense neurally oriented research in the realm of microwaves by Soviet theoreticians and practitioners is not entirely clear to this observer. While Osipov [32] states that thermal intensities are encountered much less frequently under industrial conditions owing to improved hygienic practice, clinical evaluations of the potential hazards of nonthermal intensities continue at a steady pace despite his theory that so-called nonthermal effects might well be "microthermal".

Presman [6] speculates that microwaves can be developed into a valuable tool for evaluating the physical, chemical, and, especially, molecular properties of tissues. The therapeutic uses of microwaves have been well established. Considering the rapid development of laser technology, it seems logical to expect that Soviet theoreticians, researchers, and hygienists will soon turn their attention to the biological, and perhaps even neural, effects of this factor. The Soviet use of lasers for ocular surgery is already well known (Helmholtz Institute of Eye Diseases). Recently, the first Soviet report to come to the attention of this observer on the biological effects of ruby laser radiation was published. Gorodetskiy et al. [42] described experiments designed to study the laser absorption characteristics of blood, skin, muscle tissue, and various other animal organs and tissues. No neural structures were mentioned, nor had any of the authors' names ever been noted in connection with microwave-oriented biological research. It seems reasonable to speculate, however, that the valuable experience gathered by microwave researchers would readily lend itself to laser problems.

Of incidental interest relative to the possible ramifications of microwave research is the recent announcement [40] that a special bioinformation section has been organized under the aegis of the Moscow Board of the Scientific-Technical Society of Radiotechnology imeni A. S. Popov. The purpose of this section is to study parapsychic phenomena; it is composed of radioengineers, technologists, hypnotists, medical doctors, biologists, and physiologists, including A. S. Presman, Yu. I. Kamenskiy, and Yu. A. Kholodov, the three leading Soviet spokesmen for the nonthermal effects of microwaves (and magnetic fields) on neural structures. This group held its first meeting on 11 October 1965 to discuss "Some Problems of Parapsychology." The section will proceed to analyze the world literature on parapsychic phenomena, to record and classify observable cases of "spontaneous" telepathy, and actually conduct experiments dealing with naturally reproducible telepathic phenomena. Professor and Doctor of Technical Sciences I. M. Kogan, Chairman of this Bioinformation Section, stated in the announcement that, "The era of sensation concerning telepathic phenomena is over. There is no need to dispute its existence, but rather a need to investigate its nature."

Since the initial announcement of the organization of this section in early 1966, only one additional bit of information has come to the attention of this observer concerning the actual function of that section [41]. This unsigned newspaper article published on 9 October 1966 mentions the familiar name of Yu. I. Kamenskiy as a participant in a telepathic experiment designed to differentiate the effects of a normal and hypnotic state on mental suggestion.

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Abstract

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This comprehensive report is based on Soviet open sources published 1952-1966 with a few sources published earlier. The primary purpose of the report is to outline Soviet research on the effect of low-intensity microwave radiation on the central nervous system of living organisms, including man. There are six sections in the report: (1) Scope of effort: organizations and individual researchers; (2) Subject development; (3) Specific neural functions and structures; (4) In vivo neural effects; (5) Neural effects of low-frequency electromagnetic and magnetic fields; (6) Clinical, therapeutic, and hygienic aspects. Each of these sections may be read independently. The Discussion which follows summarizes important facts and deductions from the foregoing sections and speculates on the intensity and type of Soviet research efforts in this area in the future. The bibliography at the end of the report includes 42 entries.

2. Subject development

As far back as 1933, Soviet scientists were beginning to show interest in the effects of electromagnetic fields (EMF's) on the central nervous system (CNS) of both humans and animals. In a 1957 review article, Livshits [1] cited no fewer than 28 Soviet publications on this subject which had appeared by the end of the 'thirties. Even therapeutists were actively concerned with the effects of UHF therapy on the human central nervous system. Turlygin's account [2] in 1937 was one of the first of its kind to report on the effects of a microwave-range field on human central nervous system excitability. Using a very crude generator, he observed a 200% increase in the sensitivity of the CNS of a patient under his care.

During World War II there was an understandable lull in research devoted to the neural effects of EMF's which, surprisingly enough, continued into the mid-1950's. Then, after the publication of two large review articles by Livshits in 1957 and 1958 [1,3], an increasing number of Soviet articles on this subject began to appear.

By 1957 [1], the Soviet approach to research on the neural effects of EMF's was broken down by Livshits into the following categories: 1) comparison of the effects of EMF's on denervated and intact organs; 2) the use of neurotropic drugs or stimulants to amplify the neural effect of EMF's; and 3) comparison of the effects of EMF's with the effects of extensively investigated stimuli such as heat and cold to demonstrate a specific mechanism of EMF effects. This same basic approach is still true of the Soviet effort in this area. However, as the research, development, and production of EMF-generating equipment has intensified, so has concern for the medical condition of personnel working in the vicinity of various EMF sources such as klystron and tube generators. As this report will demonstrate, medical doctors and hygienists have become increasingly concerned with the nonthermal, or so-called "specific" effects of low-intensity (less than 10 mw/cm^2), microwave-range EMF's. Since Livshit's two review articles, Soviet interest in the neural mechanisms of EMF effects has increased dramatically, research approaches have been refined as a result of radioelectronic developments, and a large Soviet community representing a multitude of disciplines is now devoted to the theoretical and practical aspects of the effects of EMF's on neural structures and functions.

2. US Embassy (Moscow)
Employee bio-damage
(thermal and athermal)
Hazard at: **0.1 - 15μW/cm2**
(Source: X-rayed Without
Consent; Bert Dumpé; 1989
per Dept. of State records)

4
VDT STUDIES—UNITED STATES AND CANADA

Many investigations have been conducted to determine the cause of VDT user trauma. Studies in at least six countries were original (the United States, Canada, Spain, Norway, Sweden, and Finland). The conclusions in the other several hundred investigations were essentially based on hearsay. Nevertheless VDT experts refer to the overall work as "scientific data."

The National Institute of Occupational Safety and Health, which monitors the welfare of people in offices, examined at least 19 computerized workplaces since 1975. To date, the agency's conclusions have not deviated from their first opinions in which NIOSH stated:

1. VDTs are harmless.
2. Emissions are too low to measure, and are therefore well within human tolerance.
3. User complaints are imaginary.
4. Stress is due to poor posture and job dissatisfaction.
5. An ergonomically treated environment will eliminate user complaints.
6. Concern is unwarranted.

Despite the assurances of NIOSH and other responsible parties, VDT user complaints persist and escalate. The maladies people describe resemble those associated with radiation sickness. Physicians have not recognized this.

The work of American and Canadian investigators is summarized in this chapter. Some conclusions were referenced by experts at the 1981 and 1984 congressional VDT hearings. Most studies reported here and in chapter 6 were overlooked.

4-1 NONIONIZING RADIATION

One of the earliest indications scientists and physicians had that nonionizing radiation induces biological damage was in the American Embassy in Moscow. Since 1953 the embassy was the target of microwave illumination from a Soviet transmitter. Employees developed unusual symptoms and diseases; some died. The Department of State (DOS) requested a facility and medical investigation.

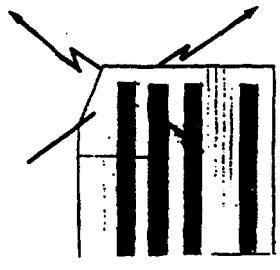
DOS FACILITY

The National Telecommunications and Information Administration (NTIA) responded to the DOS by commissioning Johns Hopkins University to perform a facility study. The Applied Physics Laboratory (APL), a division of the university, analyzed microwave measurements taken by DOS personnel over a 25-year period. A summary of the evaluation follows.

The 10-story embassy building was the target of illumination from a Soviet microwave transmitter for 25 years. Throughout the period, the distance of the radiation source was approximately 100 meters west, east, and south of the building.

The illumination of the Chancery is divided into two periods. The first 22 years (1953 to May 26, 1975) was given the code name TUMS. The second period (May 28, 1975 to February 1977), MUTS, was divided into two phases: MUTS-1 and MUTS-2.

TUMS. During this period there was a single source of illumination. The microwave beam radiated from a Soviet apartment house about 100 meters west of the Chancery. The highest radiation levels measured were within 2 feet of doors and windows on the west wall. The average maximum exposure was 5 microwatts per square centimeter.



MUTS-1. Microwave energy was high for 8 months. Beams were directed from the east and south. The average maximum exposure was 15 microwatts per square centimeter.

During part of MUTS-1 (July 1975 to January 1976), microwave transmission originated from two sources: (1) the roof of an apartment building 80 meters east of the Chancery, and (2) an office building nearly 80 meters south. The east facade of the Chancery had many windows. The south had windows in rooms 901 and 1001, and the stairway on the 8th and 9th floors.

From 24 to 31 July 1975, room 901 had an average radiation level of 9.0 microwatts per square centimeter throughout the area. Microwaves were focused sharply on the upper floors. The highest radiation levels recorded were in offices in the east side at the center of the building. The intensities increased toward the southeast rooftop corner, above room 1001.

The highest reading inside the building during MUTS-1 was within 2 feet of the window in room 1001. The signal strength on the rooftop on January 24, 1976 was recorded at 24 microwatts per square centimeter.

MUTS-2. Around November 1975 the energy of the Soviet transmitter, on the rooftop of the apartment building (100 meters east), suddenly dropped to 2 microwatts per square centimeter. Screens were installed on windows on February 6, 1976. The lowest energy was recorded from this date through February 1, 1977.

The microwave signal, transmitted from the south and east, produced an average maximum exposure that measured a fraction of a microwatt (less than 0.1 microwatt per square centimeter).

There was an area (region 2) where the reading was only 0.75 microwatt per square centimeter. Single individuals in the south wing were exposed to less than 0.1 microwatt per square centimeter.

In the subsequent biological study performed by Lilienfeld, the people exposed to fractions of a microwatt were grouped among the unexposed. Those working in shielded areas were also placed in that category. This is tantamount to saying that osteogenesis equipment does not affect bone tissue because its energy is too low.

Conclusion. As complete a model as possible was developed from the data recorded by DOS personnel. Matter is known to absorb microwave energy (as in microwave cooking). However the incidence of disease (morbidity) and mortality, reported by Embassy employees, cannot be attributed to the low levels of microwaves passing through the building.

There is a need for authoritative biophysical analysis of the microwave field illuminating the Embassy. At this time, it is only possible to consider theoretical biological effects from the low frequency microwave radiation beamed at the Chancery. Additional studies are recommended.

The degree of biological damage in DOS personnel would depend on dose, time, and distance. The Soviet transmitter was consistently at a distance 80 to 100 meters from each wall of the Chancery. Dose and time varied. Microwaves were strongest at the rooftop and above doors and windows which are usually framed with metal, a highly conductive material.

The APL and associated experts indicated that microwaves are "opaque to masonry walls; radiation enters through door and window openings." This may be so, but radiation can perform its work indirectly by energizing matter. This was confirmed by Russell H Morgan, professor of radiology at Johns Hopkins University and Hospital (1961). Dr Morgan, who identified the natural radioactive materials in humans and the environment, said:

> Among the radioactive elements in rocks and soil is uranium, thorium, and their decay products; and potassium. The concentration varies throughout the earth. Because rock is frequently used as a building material, masonry is an important source of radiation to which humans may be exposed.
>
> The radiation from natural sources is essentially gamma (approximately 50 mR per year), which is penetrating. Radon and thoron diffuse from the earth and building materials. Carbon, calcium, potassium, and iodine are natural constituents of the body's soft tissues and fluids. (The elements are found in the earth and in rock.)

Illumination of the Chancery's building materials must have elevated the temperature of, and increased chemical reactions in, radioactive matter in walls of the building. The secondary energy was transmitted to people. It energized elements in the body, which caused biological reactions as if their tissues were "seeing" the energy source. The more radioactive materials in the walls the greater will be the biological distress, even when the energy of the irradiation source is low.

The Soviet transmitter had three microwave intensities: medium, high, low (Table 4–1). The severity of biological damage in DOS personnel should correspond to the exposure phase, and correlate with the death rate, in the 23–year period (1953–1976). The temperature in the west, south, and east sides of the building would also influence biological perturbance.

Table 4-1 Quality and Effect of DOS Facility Energy

Exposure Phase	Microwave Intensity	Average Maximum Microwatts	Expected Biosystem Reaction
1. TUMS	Medium	5.0	Moderate, bothersome, and inexorable tissue damage.
2. MUTS-1	High	10.2	Immediate and severe damage.
3. MUTS-2	Low	0.1 to 2.0	Mild, subtle, but inexorable perturbance.

Deaths *	Males	Females
1953-1960	37	3
1961-1966	4	1
1967-1971	3	5
1972-1976	2	2
	36	11

* Due to insufficient data, 13 deaths were excluded from the statistics. The victims were all males.

A change in blood quality alone should have been indicative that something was wrong with the Embassy's environment. Lilienfeld examined diastolic blood pressure, and found that DOS personnel had a higher rate after their tour. They also had fewer white blood cells, and more psychiatric problems, than the comparison group. Experts declared that these, and other disorders were due to chance.

DOS Biological Study

Together with a team of individuals, whose expertise ranged from nursing to engineering, Dr Abraham Lilienfeld of Johns Hopkins University analyzed many health records of personnel stationed at the Embassy during the illumination period. The data was compiled with an IBM 370/148 computer. It consumed 200,000 punch cards in the initial evaluation of personnel records, and 2 to 3 times as many in the editing process.

Besides DOS employees, individuals at the post included people from the United States Information Agency, the Departments of Defense and

Agriculture, and the military. For the purpose of this discussion, all agencies at the embassy will be referred to as DOS personnel.

Lilienfeld compared the maladies of DOS personnel to those reported at other embassies (the comparison group). His team analyzed statistics of mortality and disease (morbidity) in male and female employees, and dependents (spouses and children). Generally the team found: (1) more deaths among the male population than the female; (2) a high rate of cancer in females; and (3) a high incidence of mumps, and leukemia and other blood disorders among children.

It is possible that DOS children did not actually have mumps, but swollen glands (salivary) of the tongue, throat, and ears. An unexplained outbreak of mumps was reported among schoolchildren in the District of Columbia, Maryland, Illinois, Kentucky, and other states (1988). The glands of VDT users swell. The condition may be diagnosed as mumps.

Personnel at the embassy sensed biological perturbance, which they suspected was caused by some abnormality in their environment; radiation. They measured and monitored the diabolical agent which vibrated at various frequencies, including television and FM radio bands. Microwaves were streaming through the Chancery as they do in a microwave communications tower. No one believed or acknowledged that radiation caused the morbidity and mortality occurring at the Embassy.

In research germane to the problem at the Moscow Embassy Swedish neurologist at the University of Goteborg, Dr Hans-Arne Hansson (1985), found that electromagnetic radiation affects radar and microwave workers.

> Radar workers suffered brain damage, altered spinal fluid, frontal lobe disorder, memory loss, and other neural injury. A protein, part of the white matter (glial cells) that insulates nerves of the brain, was discovered in cerebrospinal fluid of radar and microwave workers. As a result of altered proteins and retinal damage, two radar workers became partially blind.
>
> Exposure of nervous tissue to electromagnetic fields, ranging from power line to microwave emissions, may cause a wide range of biological effects. The disorders may remain silent for a period that lasts months or years. People exposed to microwaves could be at risk of sustaining brain damage. (Sally Squires, Washington Post 1985.)

Samples of spinal fluid were taken from DOS personnel, but they were not scrutinized as closely as the Hansson experiments (Koslov 1985). Had the assays been carefully studied, the Lilienfeld team might have found abnormal protein concentrations in the cerebrospinal fluid of DOS personnel. If they were using VDTs, the assays of the comparison group would have been similar. VDTs and television receivers emit microwaves like those flowing through the embassy. The radiation is not as energetic because CRT frequencies are lower. Since biological injury is cumulative, the result of high and low energy stimulation will be the same.

In the United States, Sweden, and Russia researchers observed that tissues heat when workers get too close to microwave antennas. Despite reports of adverse health effects from low level microwave energy published by Poland in 1976, the APL and Lilienfeld concluded that radiation permeating the Embassy was tolerable. A summary of Lilienfeld's investigation follows.

> The medical histories of over 22,000 people, alive and dead, were reviewed. There were 4,800 people at the Embassy between 1953 and 1976; 1,800 employees and 3,000 dependents. The comparison group consisted of 7,500 people; 2,500 employees from 9 posts in Eastern Europe and 5,000 dependents.
>
> Obviously, the most important health effect in a population is reduced longevity or early death. There were 194 deaths recorded in the studied population; 152 males and 42 females.

Since data was incomplete, the 194 figure excludes 13 male deaths from the statistics. At least 47 of the 194 deaths occurred between 1953 and 1976. This means that 147 people died during the study period (1976 to 1978). The insult (injury) that caused the result (death) may have transpired during MUTS-1 when high energy was beamed from two sources.

> The number of deaths in the male population (excluding the 13) is 50 percent of the expected mortality of the United States. No differences were observed between the Moscow and comparison group. There is no satisfactory explanation for the 42 female deaths; 80 percent of the United States population.
>
> The morbidity in the Moscow and comparison group was nearly equal. Many health problems were observed; some were serious. Only two

differences were conspicuous in the two groups: (1) the Moscow male employees had a threefold higher risk of acquiring protozoal infections, and (2) men and women in the Moscow group had slightly higher incidents of the most common health conditions reported. (According to Alexander (1965), item 2 is a telltale sign that the experimentals were poisoned by radiation.)

The health conditions of DOS personnel cannot be related to microwave exposure. No consistent pattern of increased morbidity is evident in the group exposed to other than background (natural) microwave radiation. (Individuals exposed to less than 0.1 microwatt were classified among the unexposed. Therefore ailments in this group, attributed to background, may have occurred during MUTS-2.)

Men and women in the Moscow group reported more visual problems than the comparison group. Most were due to correctable refractive errors. The men had more psoriasis; the women more anemia. (Women naturally have a lower blood volume than men.) Men reported a high incidence of depression, irritability, and memory loss. (Alexander stated that depression, and other mental perturbance, indicates that radiation has affected cranial organs.)

In view of the published articles 'that the health of Embassy personnel was in danger,' it is not surprising that the Moscow group had a higher rate of morbidity than the comparison posts. (What about the dead and extremely ill people; how were they influenced by media reports?) No relationship was found between the occurrence of health symptoms and microwave exposure.

The children studied experienced many health problems. The maladies were similar in the Moscow and comparison groups. There was one notable difference, mumps occurred twice as often in Moscow than in the comparison group. (Radiation stimulates the glands which shrink, swell, or become infected.)

Conclusion. No convincing evidence was discovered that would directly implicate the low levels of microwave radiation, beamed at the American Embassy in Moscow, as the cause of any adverse health effects, as of the time of this analysis.

Recommendations. The results of this study could be interpreted that microwave radiation at the Moscow Embassy did not produce any deleterious health effects. It should be made clear that generalizations must be made with caution. The group with the highest exposure should be analyzed at intervals of 2- to 3-year periods. A surveillance system for deaths and malignancies should also be established.

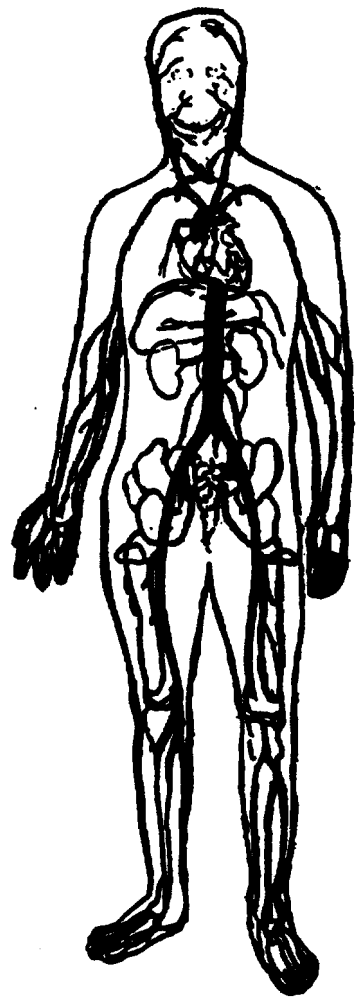
Table 4-2 lists some of the symptoms and diseases recorded. The population (N), which equals 879 DOS and 1,303 comparison, had similar maladies because the body can get sick in only so many ways. Lilienfeld noted that the incidence of eye problems, anemia, and ulcers approached

Table 4-2 DOS Personnel Mortality and Morbidity

Morbidity	Personnel in Population: DOS Personnel (N=879)	Personnel in Population: Comparison Group (N=1,303)
Sensory		
Eye trouble	319	478
Glasses	552	875
Ear, nose, throat, running ears	505	816
Sinusitis, require hearing aid	164	287
Skin, boils and disease	268	405
Cardiovascular		
Chest pain, palpitations	219	349
Anemia	6	5
High/low blood pressure	108	178
Gastrointestinal		
Appendicitis	130	216
Diabetes	7	9
Jaundice, hepatitis	96	165
Kidney stone, blood in urine, frequent and painful urination	126	189
Bloody stools, piles, dysentery	333	501
Abdominal trouble, gallbladder, digestive disorders	323	510
Nervous System		
Dizziness	37	75
Epilepsy	2	5
Headaches	74	131
Nervous problems, neuritis, stutter	78	144
Paralysis	9	27
Respiratory System		
Scarlet fever	119	182
Tuberculosis	40	77
Asthma	65	84
Chronic colds, cough, spit blood	128	192
Whooping cough	417	632
Musculoskeletal System		
Back and bone pain	143	1206
Foot trouble, leg cramps, loss of limb, swollen feet	222	332
Lameness	21	43
Glandular		
Thyroid/goiter	5	12
Mumps	597	878
Joints		
Arthritis/rheumatism	85	159
Swollen joints	75	99
Other		
Tumor/cancer	205	281
Venereal disease	57	46
Rupture	87	143
Weight change	165	246
Dental problem	102	153
Insomnia, sleep walking, nightmares	74	97
Emotional Distress		
Attempted suicide	1	3
Depression	30	56

Defects in Children Born After First Tour	Percentage Offspring: DOS Personnel (N=327)	Percentage Offspring: Comparison Group (N=428)
Spina bifida	1.0	1.0
Eye	0.0	1.0
Heart, and circulatory	0.0	2.0
Nervous system	1.0	1.0
Genital organs	1.0	1.0
Musculoskeletal	1.0	2.0
Urinary system	0.0	1.0
Cleft lip and palate	0.0	1.0
Clubfoot, other limbs	2.0	4.0

Compiled from: Abraham M Lilienfeld et al, "Foreign Service Status Study," Final Report, The Johns Hopkins University, July 31, 1978, pp 117-120, 232.



Trauma is systemic in adults, children, and the unborn

statistical significance in DOS personnel. Although not shown, male morbidity was usually between 25 to 65 percent higher than female. Taking into account that radiation always aggravates existing disorders, the data compiled for "diseases or conditions ever present" is used in this listing.

Since data was lacking, Lilienfeld's team did not correlate the maladies with the three illumination phases. This information, and the location of DOS personnel within the Embassy in relation to the microwave transmitter, is imperative to perform a thorough study. Location and period of irradiation would partly explain the variability of personnel maladies, and the death rate which probably climaxed during MUTS–1.

Between the late 1960s and early 1970s workers in various ecosystems worldwide used VDTs; a television receiver attached to a keyboard. For instance in the United States (1976), court reporters worked with a Beehive terminal (CPU) wedded to a black and white television set. Some workers complained that their "head and face felt numb." DOS and comparison group personnel may have been using similar configurations.

Lilienfeld's statistics (Table 4–2) suggest that health problems at the Embassy were no worse than maladies of the comparison group. He was alarmed by the mumps outbreak and other morbidity in children, who presumably did not use computers. The team did not qualify its information. How old were the people afflicted with mumps; below or above age 9? What caused the birth defects and problem pregnancies occurring at the Embassy after the employees' first tour of duty? The birth defects in offspring of controls and experimentals were almost equal; why? Fatigue, mental confusion, anxiety, and most disorders reported to Lilienfeld were observed by NIOSH in the San Francisco survey, and by NASA in the astronauts. The common element to which they were exposed was radiation.

The DOS facility and biological studies, like most, are inconclusive. The APL investigation concentrated on microwave measurements. There is no indication that either team analyzed other exposure (eg, VDT) DOS personnel may have had. If people, especially those in the southeast corner (rooms 901 and 1001), were using VDTs visual and other disorders would have been severe during any phase of irradiation. VDT users in the comparison group would have had similar problems.